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Are Pre-service Science Teachers' Ethical Views on Genetic Issues Affected by Their Moral Values?

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Abstract

As teachers have an influential role on the lives of their students, the moral values they impart to their students will to a great extent determine the ethical decisions made by the students. The present study aimed to determine pre-service science teachers' ethical views and moral values in relation to some genetic issues and to determine the effect of their moral values on their ethical decisions. In order to collect the data in the current study, a questionnaire that included items related to genetic issues and the Ethical Position Scale were employed. A positive and significant correlation was found between the pre-service science teachers' (N=255) total scores of their opinions about genetic applications or legal regulations and idealist (Pearson's r= 0.145, p= 0.05) or relativist (Pearson's r = 0.218, p = 0.01) moral values. The female participants were found to be more idealistic than the male participants and were found to have a greater tendency to make ethical decisions (M_{female} = 42.22, M_{male} = 40.85, t(2,193), p < 0.05).

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Keywords: Genetics; Ethics; Moral values; Pre-service teachers; Science education

1. Introduction

The Human Genome Project has apportioned 5% of its budget for ethical, legal and social issues (ELSI) and by doing so, emphasized the importance of taking ethical issues into consideration while conducting genetics research. Concerns about ethical issues are increasing with the advancements observed in the field of genetics and biotechnology because as a result of such advancements, the costs of genetic tests and applications are reducing and such applications may become more common in the future (Akman & Tuncer, 2012, p.83; Demir, 2013). Emphasis

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placed on the importance of ELSI by the Human Genome Project by contributing a considerable part of its budget for these issues has made a great contribution to the consideration of ethical dimensions while developing technologies (Edelson, 2007, p.99). In addition, in today's world, it is frequently questioned whether the purposes of gene technologies comply with the moral values of society (Genç & Demirhan-Erdemir, 1997, p.114-116).

Developments in the fields of genetics and biotechnology result in many ethical, legal and social discussions. While discussing genetic applications such as the principle of autonomy, organ transplantation, xenotransplantation and stem cell therapy, their ethical dimensions need also be taken into consideration. Science teachers who are in close contact with scientific and technologic developments should not only teach scientific issues but also the ethical dimensions of these issues ethical that should be imparted to students.

1.1. Ethical and Moral Values

Each person possesses some judgments about what is wrong or correct and good or bad. These judgments come into being as a result of the values formed by individuals throughout their lives. The concept of values, on the other hand, is made up of some structures dictating to people what the priorities should be, what should be preferred and how they should be performed (Akbaş, 2008). Ethical principles are the basic thoughts triggering the ethical values possessed by a person (Aydın, 2013). For instance, it is clear that there are some differences between the opinions of the people supporting the use of animals for biotechnological research and experiments and those people not supporting the use based on ethical principles affecting their moral values and decision making mechanisms. In a similar manner, with the steady increase in the number of people waiting for organ transplantation, the ideas of generating artificial organs and transplantation between different species have become popular. The first example of such xenotransplantation occurred in 1905 in France when parts of a rabbit kidney were transplanted into a human and this was followed by the transplantation of liver from pigs to a human in 1992-1993 (Tüzüner & Ersöz, 2006). However, such applications brought about some ethical arguments; whether or not it is ethical to use animal organs in transplantations, whether or not the transplantation of the organs taken from animals is morally correct and ethical problems stemming from the use of genetically modified animals as transplantation materials (Lei, 2004). Humans construct their ethical judgments about such genetic applications based on their ethical principles and moral values. And also it is important for an individual to be aware of their own values and to explain them in a conscious way (Keskin-Samancı et al., 2014). Educators who agree that biotechnological developments cause many ethical problems have suggested that morality and ethics need to be taken into consideration while dealing with issues such as genetic engineering (Črne-Hladnik et al., 2011).

In this respect, the relationship between ethics and education that is a process aimed to give a shape to human life from birth to death comes to the fore (Cemaloğlu & Kılınç, 2012). At that point, teachers have an important role in the education of students in shaping a society requires members to be equipped with appropriate social and ethical values (Gözütok, 1999). The teaching profession is not just limited to the transfer of information; it also has to care about ethical dimensions. Despite teachers often knowing the codes of ethics, in practice they encounter many problems (Ottekin-Demirbolat & Aslan, 2014). Debate about the challenges and issues, awareness of the complexity of ethical considerations and creating personal thinking are key issues of ethics education (McWilliams & Nahavandi, 2006). Students need to think more flexibly about the ethical dilemmas and should be able to appreciate complex situations (Carlson & Burke, 1998).

All the attitudes and behaviors affecting decisions made by students are influenced by the social environment. On ethical judgments, we see the effects of families (Keskin-Samancı et al., 2014), regional differences, ethnic culture, milieu (Forsyth et al., 2008) and the disposition of the individual (Ki et al., 2012). It has also been found that the gender of individuals is influential on decision-making processes (Wuensch et al., 2002) with females exhibiting a greater tendency to make ethical decisions than males (Lau & Haug, 2011; Ki et al., 2012). Moreover, it has been reported that age is also influential on making ethical decisions (Wuensch et al., 2002) with older people making more ethical decisions than younger people (Ki et al., 2012). Cultural life and milieu also shape people's moral values and affect their ethical decisions (Forsyth et al., 2008; Jung, 2009). Mayhew and Murphy (2009) compared 4th year university students having had ethical education with 5th year university students not having had ethical education and found that ethical education is not necessary for students to internalize ethical behaviors but affects ethical behaviors.

Although there are some anticipated outcomes within the context of elementary school science education related to ethical issues, there is no course offered in undergraduate science-teaching programs specially addressing bioethics issues. Therefore, the present study was conducted to determine pre-service science teachers' awareness of and opinions about ethical issues related to genetics. For this purpose, the present study was conducted to elicit the ethical opinions and moral values of pre-service teachers about some issues of genetics and biotechnology.

2. Methodology

2.1. Participants and Sampling

The sample of this study consisted of 255 pre-service science teachers aged between 18 and 25 years attending the 2013-2014 science education course at the Faculty of Education, Muğla Sıtkı Koçman University.

2.2. Data Collection Tools

Ethical opinions about genetics and biotechnological issues were collected using a survey questionnaire. The survey comprised of items about ethical principles, or ethical aspects of some new applications that have been introduced in current genetics and biotechnological developments (Ceyhan & Sahin, 2014). The moral values of teacher candidates' were ascertained using the Ethical Position Questionnaire (EPQ) consisting of 20 Likert-type items that were developed by Forsyth (1980). The validity and reliability of this scale in Turkey was carried out by Yazici and Yazici (2010). These authors reported the Cronbach's alpha reliability coefficient to be 0.90 for the complete scale. In this study the Cronbach's alpha value was found to be 0.70.

Forsyth (1980) defined individual differences that had impact over moral decisions by the help of two fundamental factors. First of them is relativism that is refusing universal moral rules and the other is idealism alleging that people should display behaviors leading to a true, good consequence. The participants declared their opinions to the items in the questionnaire by selecting one of the choices based on five categories consisting of "Never agree", "l do not agree", "Undecided/have no idea", "I agree" and "Fully agree". The items in the genetics survey used the same 5-point Likert-type scale.

2.3. Data Analysis

In the data analysis, the percent (%), mean (M), standard deviation (SD) and frequency (*N*) were determined utilizing the SPSS 20 software package. A *t*-test and one-way variance analysis (ANOVA) were also conducted. For multiple group comparisons, homogeneity of variance was assessed by Levene's test. The *t*-test was used in the examination of the gender variable for the survey and scale items; ANOVA was used in the examination of the regional variable that was employed. In expressions where there was no regular distribution in the items of the ethical survey, the Kruskal-Wallis test was used. When the participants viewed significant relationships between moral values and ethical principles, the Pearson's correlation coefficient was used to ascertain any associations.

3. Findings

Based on the findings of the Genetics Questionnaire, there were no significant differences between students' responses based on gender and region. When responses to the Ethical Position Questionnaire were examined in relation to gender, a significant difference was found between the idealist total scores and gender favouring the female participants ($M_{female} = 42.22$, $M_{male} = 40.85$, $t(2, 193)$, $p < 0.05$).

Based on the findings of the genetics questionnaire, means (M) and percentages for several items are summarised in Table 1 below.

Table 1. Results of the genetics questionnaire.

Item	Mean	Percentage
1. The genetic profile of an individual should be available to the concerned individuals and institutions.	2.58	25.1
2. Due to legal regulations and security precautions, the risk involved in genetic engineering is relatively lower.	3.25	35.3
3. Genetically modified organisms destroy the natural balance and pose a threat to health.	3.37	74.1
4. Genetically modified plants and animals are suitable for use except for feeding.	2.96	33.4
5. Genetically modified foods should be labelled.	3.24	91.4
6. Scientific research on human cloning should be supported.	2.85	32.9
7. If you had an opportunity, would you like to be informed about the potential diseases to be confronted with in future through data obtained from genetic tests?	4.04	77.3
8. If a potential disease were diagnosed as a result of a genetic test, would you like to be genetically treated?	4.11	79.2
9. Biotechnology is to the benefit of humans and every type of biotechnological research and experiments should be permitted.	3.62	60.0
10. It is suitable to use animals for biotechnological research.	3.56	59.3
11. The issues mentioned in the questionnaire should be taught to students at elementary and secondary schools within a course.	3.91	75.3

The results of the EPQ scale revealed that the participants who obtained a mean score higher than 41.71 to the idealism items (n=132) are defined as *idealist* and the participants who obtained a mean score higher than 33.44 to the relativism items (n=137) are defined as *relativist*. There is a significant positive correlation between the pre-service science teachers' opinions about the items "Genetically modified organisms destroy the natural balance and pose a threat to health" (Pearson's r = 0.149, $p = 0.05$), "Genetically modified foods should be labelled" (Pearson's r = 0.136, p = 0.05), and "The issues mentioned in the questionnaire should be taught to students at elementary and secondary schools within a course" (Pearson's r = 0.192, $p = 0.01$) and their idealist moral values.

There is also a significant positive correlation between the participants' opinions about the items "The genetic profile of an individual should be available to the concerned individuals and institutions" (Pearson's r= 0.217, p= 0.01), "Scientific research on human cloning should be supported" (Pearson's r= 0.215, p= 0.01) and "Biotechnology is to the benefit of humans and every type of biotechnological research and experiments should be permitted" (Pearson's r= 0.123, p= 0.05) and relativist moral values.

When the questionnaire items were analyzed in terms of total scores, the pre-service science teachers' (N=255) total scores for their opinions about genetic applications and legal regulations were found to be significantly and positively correlated with their idealist (Pearson's r= 0.145, p= 0.05) and relativist (Pearson's r= 0.218, p= 0.01) moral values.

The analyses conducted in relation to demographic variables revealed significant differences among the students' responses to the ethic questionnaire based on gender and region. When the idealism and relativism total scores taken from the ethical position scale were examined in relation to gender, a significant difference between the idealist total scores and gender was found favouring the female participants (M_{female}=42.22, M_{male}=40.85, t(2.193), $p < 0.05$).

4. Discussions and Conclusion

Individuals' ethical decisions about issues of genetics are associated with their having idealist or relativist points of view. In this regard, a significant positive correlation between the pre-service science teachers' opinions was found about the items "Genetically modified organisms destroy the natural balance and pose a threat to health"

(Pearson's r= 0.149, *p*= 0.05), "Genetically modified foods should be labelled" (Pearson's r= 0.136, *p*= 0.05), and "The issues mentioned in the questionnaire should be taught to students at elementary and secondary schools within a course" (Pearson's r= 0.192, *p*= 0.01) and their moral values being idealist. According to Forsyth (1980), idealist individuals always avoid behaviours that may harm others and even if they have to make a selection between two bad events, they put off their decision as long as possible. In this connection, the findings of the genetics questionnaire indicated that the participants were of the view that the genetically modified foods should be labelled to protect people from their possible adverse effects but even if the necessary precautions are taken to protect people, they still can be harmful to nature. The relationship between this opinion of the participants and their having an idealist point of view always supporting proper actions is one of the findings of the current study.

A significant positive correlation between the participants' opinions about the items "The genetic profile of an individual should be available to the concerned individuals and institutions" (Pearson's r= 0.217, *p*= 0.01), "Scientific research on human cloning should be supported" (Pearson's r= 0.215, *p*= 0.01) and "Biotechnology is to the benefit of humans and every type of biotechnological research and experiments should be permitted" (Pearson's r= 0.123, *p*= 0.05) and their moral values' being relativist was found.

The individuals agreeing with these items do not seem to be concerned about the risks of scientific developments under debate. Support given to these items by the relativist individuals complies with the Forsyth's (1980) definition of an individual whose moral values are relativist. According to Forsyth (1980), relativist individuals are concerned about conditions rather than violation of ethical principles; therefore, for them, the current state of an occurrence is important and they make their decisions based on this current state. When the responses to the genetics questionnaire were examined in relation to the variables of region and gender, no significant difference was found; yet, according to the ethical position scale, there is a significant difference between the opinions of the participants with an idealist point of view in favour of female participants (M_{female}=42.22, M_{male}=40.85, t(2.193), $p <$ 0.05). Ozer-Keskin et al. (2013) noted that decisions of pre-service teachers generally did not differ by gender but significant differences in the genetic screening test were obtained. Wuensch et al. (2002) stated that gender is an influential factor in ethical decision making processes and general results obtained from research show that females have a greater tendency to make ethical decisions than males (Lau & Haug, 2011; Ki et al., 2012). In studies investigating the effects of region of residence on individuals' moral values, Forsyth et al. (2008) and Jung (2009) found that regional differences, ethnic culture and milieu are influential in shaping the moral values of individuals.

5. Suggestions

The pre-service teachers' ethical opinions about ethical issues such as genetically modified organisms, cloning and legal regulations concerning genetic applications and their moral values are associated with each other. As the moral values of individuals affect their ethical decisions, it is important to educate individuals who can make "good" and "correct" decisions about such issues. It is believed that individuals equipped with ethical values will be closer to "good" behaviours. When such people encounter any genetic application about which they have difficulty in deciding, it is clear that they will adopt an attitude supporting the behaviour leading to a correct outcome. Thus, such issues should be considered while designing course programs for pre-service science teachers. As long as individuals who can make "correct" and "good" decisions in their social milieu and families and develop behaviours useful for everything either living or non-living, the level of concern and discussions about genetic applications resulting from developing technologies will decrease. Moreover, due to their subject area, pre-service science teachers who are informed about the scientific and technological developments should be able to discuss the social dimension, human-environment interaction and negative and positive influences of these developments on life. For this purpose, the students can be provided with some scenarios to discuss in a lesson dealing with a technology or issue whose ethical concerns are under dispute so that students can discuss the pros and cons of the technology.

The current study is limited to the opinions of the students of Muğla Sıtkı Koçman University Science Teaching Department. In light of the findings of the current study, a more comprehensive study on a bigger sample needs to be conducted.

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